NTUA / HGL

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IPGP

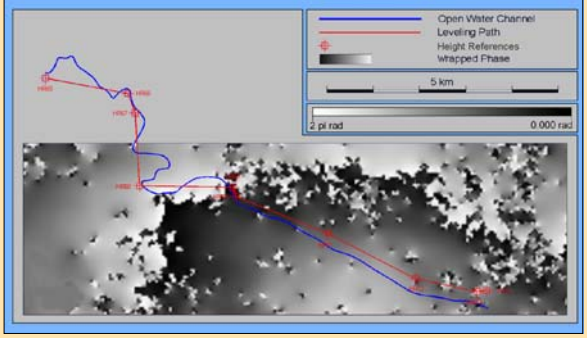
Verifying InSAR derived Vertical Differential Displacements by Leveling. Application along the Mornos Open Aqueduct.

Objectives

1. Extracting deformations induced by tectonic activity along one dimensional features from 2D interferogram images
2. Rendering SAR interferogram – derived deformations quantitatively useful
3. Verification and Evaluation by means of conventional terrestrial surveying methods

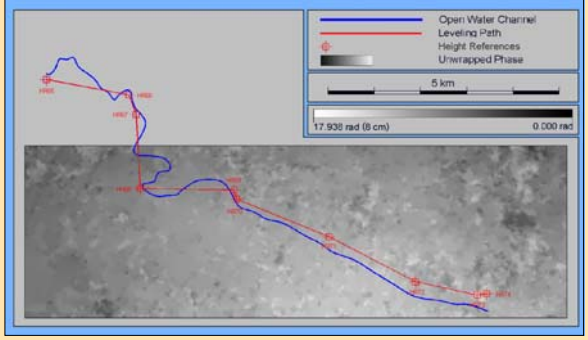
Verifying InSAR derived Vertical Differential Displacements by Terrestrial Height Observations
Application along Mornos Open Water Channel.

Levelling Path and Water Channel Plot on Wrapped Interferogram



Verifying InSAR derived Vertical Differential Displacements by Terrestrial Height Observations
Application along Mornos Open Water Channel.

Levelling Path and Water Channel Plot on Unwrapped Interferogram



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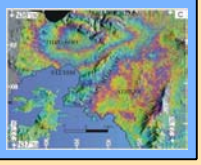
InSAR Processing

Image	Orbit #	Acquisition Date/Time	Frame #	Track #	Altitude of Ambiguity h_a	DTM	
Master	17854	19/09/1998 09:06:51 UTC	2835	465	-67.236 m	Resolution	Height Std Dev
Slave	23365	09/10/1999 09:06:47 UTC	2835	465		50 m	10 m



Terrestrial Height Measurements

1984: Measurement of Vertical Network with Heighting Triangulation

2001: Re – surveying of Vertical Network with Leveling

Vertical Network Apex (Reper)	Height Differences between 2001 – 1984 (m)
HR65-HR66	-0.008
HR66-HR67	-0.003
HR67-HR68	-0.021
HR68-HR69	-0.004
HR69-HR70	-0.005
HR70-HR71	-0.003
HR71-HR72	-0.001
HR72-HR73	-0.003
HR73-HR74	-0.001

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Interferogram – Terrestrial Height Differences Measurements Incompatibilities

1. InSAR processing provides wrapped interferograms, which means than not the full phase difference is provided, but only its fractional part.
2. InSAR does not provide the true vertical differential deformations, but their projection on LOS.
3. In this particular case, the reference systems of the leveling and the InSAR work, are different. InSAR interferograms are in ED 50 UTM 34, while the total of the leveling work was completed and its outcome expressed in HGRS 87 map coordinates.
4. The interferograms are corrupted by noise, which – mainly due to temporal decorrelation – may reach extremely high levels (perhaps even 1 π), a fact that is a potential threat for the reliability of point wise displacement extraction.

Verifying InSAR derived Vertical Differential Displacements by Terrestrial Height Observations
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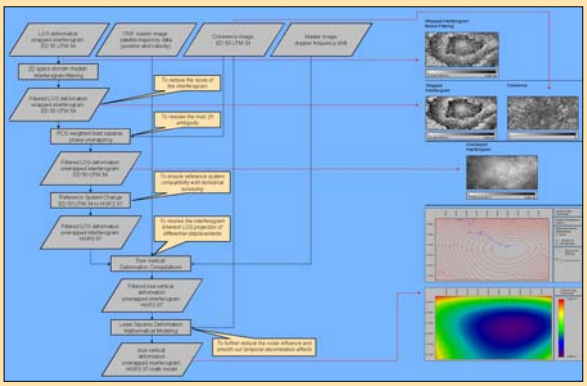
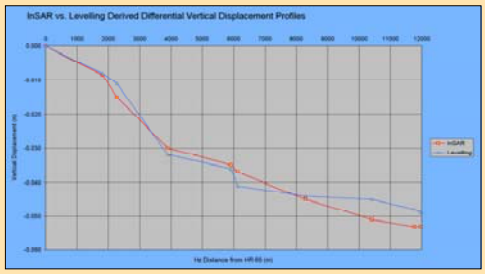


Verifying InSAR derived Vertical Differential Displacements by Terrestrial Height Observations
Application along Momos Open Water Channel.



Differences between two Sections attributed to:

- SAR sensor noise
- Mathematical model deviations
- DTM errors
- Leveling errors
- Height Triangulation Errors